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"THEORETICAL NATURAL TERRAIN" AND "ACTUAL NATURAL AREA," USING NORTHWESTERN LOWER SAXONY AS AN EXAMPLE

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I. The Problem

Over a period of decades, the concept of geographical terrain has been largely defined. Likewise, the concepts "natural terrain" and "cultural terrain" have become well defined, the former as a complex of physiogeographical and biogeographical elements and factors, not significantly affected by anthropogenic factors, and the latter pertaining to significant transformation and modification of an area by human activity (12). Members of the West German Geographical Society have been primarily responsible for a further clarification of the concept of "terrain," which has come to mean the totality of a portion of the earth's surface, insofar as it may be conceived of in standard terms, while the extent of particular terrain components or portions of the complex is designated by the term "region," "district," "area," etc (12). Thus, we use the term "natural area," if we wish to describe the nature of a territory or terrain within the boundaries determining its extent, without consideration of the phenomena of human culture. Thus, in anthropogenically-determined spaces, one may speak of units, structures, or components having to do with natural area, economic area, or social area, etc, each of which constitute no more than an element or constituent of a territory. However, if terms such as "natural terrain," "cultural terrain," "rice-growing terrain," etc., are used,

reference is made to the totality of the characteristic features of the terrain, the adjective being used only to indicate dominant phenomena (1).

However, debate continues over whether by "natural area," "composition of a natural area," etc, in terrains highly affected by human activity, is understood a reconstruction of the natural area as it would appear if human beings had not been present, or the natural geography as it presently exists, with its long-term man-created effects on the soil, hydrography, botany, etc. Here are 2 examples among many. One geographer asks (5): "How would the present terrain, under existing natural conditions, appear, if man had not affected it in any way?", to which he adds explicitly: "Man and his works must be left out of consideration." On the other hand, another says: "It is not possible, and, in any case, of little value, to disregard such natural and human influences and ... , in the classification of natural areas, to base ourselves solely on primeval conditions. Natural conditions and those created by cultures and techniques are so closely intertwined as to make an artificial separation impossible. Therefore, it is not only permissible, but essential, to take the existing conditions as the point of departure" (6).

Both approaches are meaningful and justified. It is evident, however, that the reconstruction of a theoretical natural terrain involves many more hypothetical considerations than does the existing natural area, which is capable of direct observation. As the effects of human activity upon the natural area go back thousands of years in some cases, and as they enter early into what is often a highly complex series of causes and effects, the reconstruction

of a fictional natural terrain must, in many portions of the earth, involve so many unknowns as to be reduced to nothing more than an intellectual exercise.

The difference between the natural geography of a given terrain as affected by man and that of the same area freed of anthropogenic influences and restored to its "theoretical" state, is often slight, however, or at least this would appear to be the case. Can the two be harmonized?

We shall attempt to investigate this problem by using northwest Lower Saxony as an example. The exceptionally fine cartographic material available for coastal Lower Saxony (17, 18) provides a substantial basis for reconstruction of the "theoretical" topography of the natural area to produce a natural terrain unaffected by man. The characteristic features of the topography of this natural area, and of its genesis, must be assumed to be familiar, so that the problem may be reduced to the question at issue.

II. The "Theoretical" Natural Terrain of Northwest Lower Saxony

We pose, first, the question as to how the land would have appeared if man had not brought his influence to bear on the natural geography of the area. Chart 1 gives the answer in a broad, basic outline.

Let us begin with the coast and marshlands. The mean sea level, the datum level of the official topographical charts, is at least one m, and often more than 1½ m below the mean highwater level (MTHW-Fl.). This means that, if not for the building of dikes since about 1000 A.D., the marshes would be covered with salt water twice a day, while the highest sea level in storms would cover all land up to the 3½ m mark, or, more likely, up

to the 5-m isohypse, indicated in Figure 1 by the horizontal hatching. East Friesland would be a narrow peninsula, less than 30 km wide, in spots, less than 15 km wide. It cannot definitely be determined whether today's marshlands would be sand and mudflats or whether, in part, they would be swamp, nor whether high storm tides would have shaped the flats and coastline differently. Anyone who would find pleasure in it is entitled to speculate as to what the amplitude of the tide would be in the courses of the Weser and Ems Rivers, as they would exist under these circumstances. The original settlement of the undiked marshlands, ascribed to the Iron Age, would not have affected the coastline as shown, as the sinking of the coast, which today is perhaps ending, was then in progress (16). The edge of the marshes is to be sought as a false channel up to about a meter over mean high water in the storm tide area. The marshes would not have taken the form of rich fresh-water meadows and pastures, such as exist today, but would have consisted primarily of salt-grass meadows. The dense network of drainage ditches in the marshlands of today would of course have been absent. The natural terrain would not be significantly affected if allowance be made for settlement in the marshes due to diking and drainage (2, 3).

In the inland districts as well, the transformations wrought in nature by man are significant.

In a series of studies Wildvang (15) has convincingly demonstrated that settlement of the low boglands took place, in part, in prehistoric and early historic times, with the result that they, and the edges of the high boglands, had undergone marked changes over long centuries. The settled strip from Osteel-Marienhafe

to a point upstream from Neermoor (near Leer), like other settlements on the edge of the land above sea level, lies on the edge of marshlands raised by the heaping up of sand for protection against the encroaching North Sea. The broad low boglands of the Aurich plain above sea level have been highly eroded. Their arable soils are hardly to be distinguished from the bogfree land above sea level, revealing merely (except for occasional residual areas of peat) a slightly higher humus content than the "pure" seacoast soils (10%, by comparison to about 3%). It took incredible labors on the part of man to become a factor in nature. Without man's thousand years of work, not only would today's marshland meadows still be alder bogs, but the high marshes, growing both in height and width, would have by now to cover much larger areas. It is impossible to determine how large they would be by now, so that the chart of the theoretical natural terrain must depict all types of marshland as one. All the low country is now, and has long been, drained land covered with a network of canals and ditches, as is splendidly depicted in the corresponding charts in the Lower Saxony atlas. Plant communities and soil types are particularly good indicators of the topography of an area, and permit reconstruction of the theoretical natural terrain with a high degree of confidence. The dry portions of the land above sea level are now covered with oak and birch woods, while moist portions are covered with the wetland varieties of these trees or with bogs. Only on the better soils, consisting of boulder clay with clayey to clayey-sandy soils and loose sands and clays, are sour-soil oak-and-hornbeam woods found to predominate.

Would these types of plant communities return everywhere if man were to disappear? No. Where human activity has resulted in soil degradation, this is most improbable. Thus, on the sandy land above sea level where moor soils have appeared in the place of "rust-colored forest soils," only heath vegetation and stunted trees are able to grow, due to the layer of bog iron (see bog-iron soils in Figure 2). All the soil types in longsettled areas may be assumed to have been significantly affected by human economies, so that present-day soil science has begun to treat of man as a more important soil-forming factor than was hitherto believed to be the case.

With this we may conclude our consideration of theoretical natural terrain, as it has already become amply clear that it is fictional and can hardly be regarded as of practical significance. Geographic regional and area studies and regional planning must deal with those realities of the natural area which are subject to direct, on-the-spot observation. Moreover, it must be stated that the maintenance and improvement of the conditions actually existing in the natural area are among the most important problems of regional planning and agricultural engineering. That this is clear is illustrated by the diked marshlands, with their great problems of diking and drainage: land which does not exist at all in the "theoretical" sense. The study of the theoretical natural area requires the use primarily of a deductive method, while the real natural area must certainly be studied by inductive reasoning based on observations on the spot.

III. The Actual Natural Area of Northwest Lower Saxony

The permanent changes produced by man must be given prime consideration in studying this area.

Most of the marshland is below the mean highwater level, and is protected from regular salt-water flooding by dikes 7 to 8 m high. The groundwater level is therefore high, and the impregnation of the soil with moisture is considerable. Only when the tide brings the sea level below that of the marshlands is it possible for the water in the innumerable drainage ditches to flow off through the levees. It has only been quite recently that, as at Emden, powerful pumping installations have been erected -- installations capable of rejecting the excess water past the dikes during long periods of high water. Time and human activities have caused the settling of the marshes to be reflected in relief, hydrography, and ecology. Wherever subsurface bog layers are thick, but in any case to a greater degree in the old marshlands at the edge of the geest than in the younger marshes, settlement is more marked. The consequences are that drainage is more difficult; the soil often undergoes a mild degree of wet bleaching in a band extending in width from a few hundred meters to over 10 km in front of the East Friesland plain (18); and in many places the groundwater comes to the surface in the form of "lakes," some of which are maintained as natural reservoirs, although recently this has occurred as a result of the building of the dikes, and of the settling of the land. As a result, the older marshes are distinguished from the younger by a higher proportion of cultivable land than the younger. Today's outer dike line is the outcome of the struggle between breaks caused by storm tides and man as dike-builder, wringing the

and from the sea polder by polder. The "spare dikes," which are often "nibbled at" as supplies of earth when needed elsewhere, and the numerous mounds for individual farmyards and villages, which may extend for many kilometers and represent unique types of zones both of habitation and of vegetation, constitute a type of human ornamentation of the marshland which, while relatively small in area, is nevertheless subject to slow modification, if any. The changes in the hydrography and the vegetative geography of the marshland by anthropogenic factors has been discussed above. It may be stated with confidence that, if not for man, the marshland as a natural area would be entirely different than it is today not only ecologically, but in its contours, boundaries, and topography. In a word, the theoretical natural terrain would be entirely different from the actual natural area, and in fact would, for the most part, not be solid land, but tideflats or sea. Even the sea bottom outside the dikes is largely a result of human activity, forming a false channel, the depth and extent of which are markedly effected by man (through dredging) in interrelation with natural forces.

But even the geest (which, in the popular vocabulary, represents all sandy land that is, relatively, dry, and high, if only a few handbreadths above the moist surroundings) is affected by permanent human transformations of the natural endowment of the area. Improvements in the physical geographical environment cause substantial resistance to degradation.

In the western portion of the Aurich geest plain, the improvements consist primarily of the elimination of many, many square kilometers of shallow bog cover, muck and soil by drainage or mixing

[illegible] in contrast to the higher geest soils, these anthropogenic geest soils contain more humus and an excessively high groundwater level, which requires drainage is most cases. Local conditions vary from place to place with the slightest differences in microrelief and soil (sand, loamy till, and, occasionally, clay). The natural meadows lie high, also outside the limits of the subsidence of the bog meadows. The situation chiefly answers the requirements of a moist oak-and-birch woodland, except where there are alder-quakes, swampy heath, or, in the occasional high spots, dry oak and birch woods. In districts where the East Friesland geest is more deeply dissected -- the northeast and the Ammerland, where interlaced dissection due to parallel channels on the interfluves has created dry spots, with rust- colored forest and heath soils -- dry oak-and-birch forests and Calluna heath with stunted forest would exist if not for the fact that they are largely under the plough and have become metamorphosed by superimposition thick layers of turfy soil.

The Huemmling and Cloppenburg geests are relatively and absolutely higher than that discussed above. The Huemmling soil is poorer than that of the geest further eastward, perhaps because the soil substrate had from the outset, and with the intermixture of poor tertiary sands in the till, offered little of nutritive value. Dominant in this area are markedly bleached rusty forest soils with dry oak and birch forests (now often pine), and, primarily, heath soils with hardpan. Loose sandy soils are much more valuable, but in this area the addition of a loamy component to the loose sandy soils produces even better spots. Thus, in this area one finds brown forest soils, weak to highly podsolized

rust-colored forest soils and, in places, chiefly where there is standing water over loamy soils, wet forest soils. These conditions would result in variants of oak-hornbeam woods but for the fact that the good soils that we are discussing have for the most part been broken by the plough. This also holds for other loose sandy soil districts (on the slope of the Dammer Hills and the Ankumer Heights). The Dammer Hills consist chiefly of dry geest with oak and birch woods on rusty forest soils, tending, in spots, as do other portions of the dry geest, to form dunes and drifting sands.

Our figures depict heath soils with hardpan separately. In the form of small islands they extend over larger areas than the charts are able to show. Their extent is greatest [illegible] soils of the Meppen-Nienburg geest and at the foot of the Dammer Hills. They also appear in the hollows of old sand dunes and on geest islands, or terraces, near rivers, at points where the groundwater is somewhat lower. Doubtless, they were produced by wasteful plundering of the woods and pasture on the onetime extensive common lands. Primarily, however, they are the negative handmaidens of the creation of turfy soil, for the benefit of which, for many centuries, and perhaps as long as 2,000 years, the humus surface substance has been taken in the form of sods transferred to cultivated fields via the stalls of livestock. Students of plant communities believe that they see in the strata at the B level below the hardpan the profile of the one-time oak and birch forests. One hectare of land under long cultivation with manured turf fertilizer requires 5 to 20 times its area as turf source in the heath. It is little wonder, then, that the layer of bleached sand over the hardpan often displays a disproportionate relationship to the zones of enriched soil in the B horizon which often contain

20 to 30 cm of iron-rich humus-containing hardpan, while the layers of bleached sand have often been stripped down, by the removal of turfs, to less than 15, and even to 5, cm thickness. As a result, this layer is often so thin as to be incapable of furnishing any iron and humus to the B stratum. Here only heath and stunted trees are now able to thrive, while 60 to 80-year-old pine plantings have hardly been able to emerge above the stage of stunted growth and "young" copses, because the hardpan has limited the root growth downward. Here we see an extensive, long-term anthropogenic degradation of the soil, which can be reversed only by deep ploughing to break up the hardpan and by afforestation in accordance with local conditions, or by conversion to ploughland by high outlays of fertilizer and capital, which is usually unjustified. Pine plantings alone accomplish nothing.

The mineralized damp soils of the riverine forests and meadows, too, are often highly affected by the results of human activity, not only by control over tidal flooding and drainage and irrigation, but also, in spots, by anthropogenically-caused covering of the flood-plain forests and meadows, which have been raised 2 to 2½ m during the last thousand years (7). Like the mucky low meadows, these areas have also undergone levelling (also often by removal of sod). Alder brakes have, for the most part, been converted to grasslands. In the flood plains the nutritive elements in the soil are more abundant, except where the water is stagnant.

The manner in which man has affected the life of the bogs has been described briefly above. Here only a few illustrations are needed. Comparison of Chart 2 with the map of the present state of the region (No. 21 in Source 15) shows how extensive the

changes have been even in the high moors. Those of the Ammerland, those southeast of Jadebusen, and large portions of other high moorland districts, have disappeared to a considerable degree. That is, they have been stripped, even if by no means always down to the underlying sand, and converted to cropland. There is no need here to go into the various types of high moor cultures. However, it must be emphasized that these anthropogenic changes, unlike those of the low bogs and muck country, are very recent. Throughout medieval times, the high moors were a no man's land, i. e., a wilderness dangerous to man. It took the stimulating example offered by our neighbors in the Netherlands to demonstrate the value of the upland moors and the methods of taming them. The clearing of the moor was begun in the thirteenth Century in the bishopric of Utrecht, while the fourteenth century saw the founding of moorland settlements in Overijssel and neighboring Drenthe. The bog colonies of Groning began to flower only in 1628, and in a few years were taken as the example on which the East Friesland developments, and the settlements near the border fortress of Papenburg of the Münster bishopric and the Bourtanger Moor (11, 14) were based. From then onward there was constant extension of plantings on moorlands cleared by burning, accompanied by superficial drainage. Moorland colonies were also founded. However, the effect of these efforts in transforming nature were slight in comparison to those effected by the bog colonies.

For the individual farmer to make headway against the moor is out of the question. It requires large capital outlays, primarily for the initial digging of the major drainage canals. For this reason it was urban capitalists who first ventured capital in the moor. In East Friesland it was 4 men of Emden who founded Crossefehn in 1633, originally to obtain peat in this wood-poor and therefore fuel-poor lowland. They were less concerned with winning new

farmlands. The edict on land clearance issued by Frederick the Great in 1765 declared all moot moorlands to be government property. From approximately 1770 on this led to many new settlements being formed on the government's initiative, so that by 1869 there were no less than 83 moor colonies on East Friesland.

Colonization of all the upland moors advanced further during the nineteenth (i. e., the founding of New Arenberg in 1809 and 1826-27, that of Neuscharrel in Oldenburg about 1821) for the most part under government guidance and planning (e. g., the founding of the model colony of Marcardsmoor by the provincial government of Hannover in 1890, and in 1908 that of the Central Power Plant at Wiesmoor). Our century has seen primarily the application of the German methods of cultivating the upland moors. Today, however, the remaining upland moors, often 6 to 8 m, and in the Bourtanger Moor, up to 14 m thick, are barren, as a result of drainage.

The largest massif of upland moor is the Bourtanger, the German portion of which covers some 40,000 ha. There may have been close to 50,000 ha of moor in the Hunte-Leda lowland. Moorland statistics are necessarily inexact, without soil surveys, particularly as it is difficult to classify, statistically, the transition areas between moors and mucky soils. In Aurich County, moor covers about $\frac{1}{4}$ of the total area, and in that of Oldenburg exactly 1/5. The area under our consideration has more moorland than any other in Central Europe.

The last of the natural area components highly modified by man that we shall examine are the old cultivated areas, which in Western Germany, are generally manured-turf-sodded soils (9). They are found not only on homesteads and squatter farms, constituting the long-cultivated ploughlands of the small settled communities, but also in the long-cultivated lands of village farmlands in solid blocks, as well as in enclosed isolated farms and even on the farm laborers' patches. Only in the decade before the war was fuller knowledge of these soils obtained, and the types more clearly delineated. The surveys for the Lower Saxony soil atlas contributed significantly in this respect, but its distribution as shown therein is merely a reflection of the prior knowledge in the field, and therefore inadequate. Thus while our Chart 2 presents a general picture of the distribution of manured-turf-compost soils, it shows none in districts where they have recently been discovered. These include the Aurich geest plains, where they are found in the mucklands, and on the loose sandy soils of the Cloppenburger geest (where I have often found layers of manured-turf-compost soils up to 60 cm thick in random samplings; it has also been found in the flottlehm -- soil intermediate between loess and wind-transported sand -- of the Hoyaer geest, and this is shown in the soil atlas). Manured-turf-compost is found over all types and classes of soil, except for upland moors and, perhaps, the silt of the marshlands. Its distribution shows a relationship to the ancient pattern of settlement, for in places where continuous or dispersed settlements had not come into being until the middle of the past century, and the farmers had lived in small homesteads, manured-turf compost soils had been limited primarily to the appurtenant homestead ploughlands and to small adjacent

enclosed fields. This is the case in Hümmling. In areas of dispersed settlements, manured-turf-compost soils are found outside the homesteads in broad dispersal on the ploughed enclosures (this being the case in central and southern Oldenburg, and in the northern portion of the Hoyaer geest). Most of the manured-turf compost-enriched soils found in the area under study are on rust-colored forest and heath soils, although in spots they have been laid down over hardpan. The creation of the humus horizon represents an enormous amount of labor, which probably took 1½ to 2 thousand years in the fields longest under cultivation. The humus horizon is not more than 50 to 100 cm thick, although greater thicknesses are not uncommon. They represent an artificially-created area of plant growth, the soil rating of which is substantially higher than that of the adjacent forest and heath soils. In the "theoretical natural terrain," however, the soil rating for manured-turf compost-enriched soil and for the areas from which the sod had been stripped would be approximately the same. If the former were left at the mercy of the forces of nature, it is probable that the forest vegetation of the locality in its virgin state would take over, in its "better" varieties.

The long-term changes wrought in the natural state of the area by turf-stripping farming may be seen in many thousands of hectares of land, whether this be the stripped land, with its degradation of the "natural" soil known to every farmer, or whether it be manured-turf, compost-enriched soil, constituting an artificially-created, new area of cultivation with improved humus content, friability, and change in the water economy of the soil, etc.

[illegible] solid mineral substances alone removed with the turfs may be seen from some simple rough calculation. If one assumes that the ground level has been raised by an average of only [illegible], then a single farm of only 6.) ac of arable land requires the moving of [illegible] m³ of earth; and a tiny homestead settlement of only [illegible] farms, having 6.) ac each, involves the transfer of 25,000 m³ of earth. This means that in the area under discussion, alone, many millions of cubic meters of earth, here degrading the soil and there improving it, have been moved! As a result, banks formed by high water have been levelled extensively by turf-stripping, terrace rims have been straightened, terraces containing arable have been raised and smoothed, so that the relief itself has been affected. The areas stripped of turf have often been converted to shifting sands, which still exist, and which it is difficult to fix by forestation.

However, all the foregoing are anthropogenically-conditioned changes in nature, changes difficult to reverse, which would remain for a long period and, in part, permanently even if man withdrew from the area and a new "natural terrain" thereby came into existence. These factors are effective and of significance in area studies and regional planning.

All areas of farming, including, in the broader meaning, those where the land is merely despoiled, show directly or indirectly the effects of human efforts, among them long lasting changes in actual nature. Think, for example, of the flood-deposited sedimentary cover in many flood plains as the result of colonization of upriver areas in many places other than northwest Germany, of the often devastating long-time results of soil erosion, such as the

washing away of the soil after deforestation in the lands of the Mediterranean, or the dust storms subsequent to destruction of the natural vegetative cover which resulted from putting the Great Plains of the USA to the plough. In the latter case alone, important portions of the humus horizon of the topsoil were lost. Or think of the change in vegetation caused merely by scratch-and-move agriculture on the savannahs and steppelands of the earth. Examples such as these may be multiplied by the hundred.

It would thus seem to be established that "actual natural area" is a concept of greater scientific and practical significance that any "theoretical natural terrain," which is often incapable in any case of being reconstructed with any certainty in important respects.

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FIGURE CAPTION

Figure [opposite page 64, original].

Theoretical natural terrain: hypothetical representation of the natural state of northwest Lower Saxony if man had not made his presence felt.

The coasts indicate the approximate coastline at mean high tide in the absence of the dikes, but without consideration of the probable, but nondeterminable changes that have occurred. Place names are provided for orientation. Shape and position of islands cannot be reconstructed for the period in question.

Upland and lowland moors, boglands, muck lands.

Lowland moors and alder brakes.

Primarily oak and birch woods, chiefly on poor (rusty-brown), sandy geest soils.

Oak-and-hornbeam woods in the lowlands, chiefly on acidiphilic silicate soils (ground moraines and loose sand).

Areas which would be covered by storm tides, and probably silted over, on the basis of the topography of the present day.

Up to about one meter over mean high tide (=2 m over mean sea level): presumptive marshes (false channels). Sources: Atlas Niedersachsen [Atlas of Lower Saxony], 1950; Bodenkundlicher Atlas von Niedersachsen, [Soil Atlas of Lower Saxony].

Figure [opposite page 65, original].

Actual natural area: major natural features of northwestern Lower Saxony, with consideration of long-term anthropogenic changes.

Sea and river marshes: diked, chiefly below mean high tide level; marsh-marine humus and clay soil, mineral wet soils with fresh water, extensive drainage systems; soil ratings between 58

and 59 (chiefly good ploughlands and very good rich pasture and meadows).

Geest: Chiefly sandy and loose sandy soils. Anthropogenic changes: improvement by manured turf compost, while fields long under the plough have acquired humous friable soil 60 to 110 cm thick (soil ratings often between 26 and 51, but 52 to 64 on loose sand and loam); degradation due to turf-stripping (removal of the high-humus friable soil and part of the layer of bleached sand; soil ratings between 1 and 25), and conversion of the oak-and-birch forests to heath with heath soils resulting.

Heath soils with hardpan (soil ratings well below 16).

Mineral wet soils in river valleys and sandy valley floors with high groundwater level, the foregoing derived from alder brakes and lowland moors or mucklands; frequently planed and improved. On sandy clay (the Ems upstream from above Haren, and parts of the made land) the soil ratings are often 38-51 (this being the case, for example, with manured-turf-compost soils), while on ploughland and good grasslands (up to 57 along the low Ems, up to 89 in spots at Aschendorf), and 25 to 40 on moderate grasslands.

High moors: the natural state of all such lands has been changed by drainage, their level largely reduced by removal of the soil, and in places complete levelling thereby. Drainage has stopped growth of the moors in extent and height. Poor in nutritive values. Soil ratings of today's upland moors are chiefly 10 to 27, and not more than 28 to 41 in areas dug clear (bogland settlements).

Low moors, developed from silted-up areas rich in nutritive elements, and covered with alder brakes, etc. A high degree of drainage regulation, resulting in transformation of desirable meadow lands (particularly in low ground and at the edge of the geest).

Soil ratings chiefly between 25 and 41.

Muck and bog soils: in part resulting from the same processes as the lowland moors, but in part developed from moist oak-and-birch woods. Peat cover less than 25 cm thick, and, in its absence, a mixture of mineralized substrate (sand, loam, etc.), and sour humus (often similar to the mineralized wet soils). Very marked anthropogenic changes on and near the geest (probably at least 2,000 years old) by addition of sand, etc., culverts and the like, thus producing changes making it identical with humus geest soils. Soil ratings chiefly 25 to 41.

Manured-turf-compost soils: areas in cultivation from ancient times; humus horizon usually increased by 40 to 100 cm, primarily on sandy and loose sandy soils, but in some instances on loam and sany loam, primarily relatively dry (on low, flat elevations). Soil ratings vary with substratum, penetration of moisture, etc., from 26 to 64. Conditions for vegetation completely changed by man. Boundaries not precise and not presented here completely.

Sources: Niedersachsen Atlas, 1950; Bodenkundlicher Atlas von Niedersachsen.